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THE ACQUISITION OF DRIVE-ELICITING POWER

BY ORIGINALLY NEUTRAL CUES

by

ODIN C. VICK

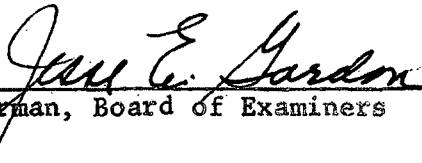
B.A. Montana State University, 1958

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requirements for the degree of  
Master of Arts

MONTANA STATE UNIVERSITY

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Approved by:

  
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OCV

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## INTRODUCTION

Behavior theorists who use the concept of motivation usually appeal to it for an explanation of the occurrence of behavior (ascribing to it an "energizing function"), and of the direction of behavior toward particular goal objects or events (a "directing function"). Such theorists have encountered problems in accounting for the existence and effects of motives such as the needs for autonomy, achievement, affiliation, etc. (named for the goal states which seem to terminate them) which are not present at birth, have no physiological components (i.e., are terminated by events which do not appear to affect physiological functioning), and do not develop, apparently, as a function of maturation alone.

Because of the characteristics just listed, the assumption is usually made that such motives are learned, and efforts to deal with them conceptually have attempted to answer questions such as the following: How<sup>1</sup> can these "social" or "acquired" motives provide a source of energy for behavior? How can they give it direction? How, for example, can association with others, or competition with them or with a standard of excellence, or independence of the control of others, transform energy for use in responding, and by reducing a physiological drive state, reinforce the learning of new responses? Any comprehensive theory of behavior must deal with this problem in some form.

The above questions can be reduced to the following one: how do stimuli which cannot directly affect the physiological functioning of

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1 The word, "how" signifies "by what means or process" and is not, of course, intended to have any metaphysical import in this context.

the organism acquire the capacity to energize and reinforce behavior? One solution has been to appeal to the principle of secondary reinforcement. Such a proposal lacks force, however. Secondary reinforcing effects are generally unstable and require frequent primary reinforcement to maintain them (Myers, 1958; Wyckoff, 1959; Zimmermann, 1957). Further, secondary reinforcers operate only on organisms already motivated by a primary drive state. Thus secondary reinforcement has been criticized as inadequate to account for the strength and persistence of such motives as those for achievement, affiliation, and autonomy.

Another proposal has been that of secondary drives, stated very concisely by Hull (1951): "When neutral stimuli are repeatedly and consistently associated with the evocation of a primary or secondary drive and this drive stimulus undergoes an abrupt diminution, the hitherto neutral stimuli acquire the capacity to bring about the drive stimuli ( $S_D$ ) which thereby become the condition ( $C_D$ ) of a secondary drive or motivation" (p. 25; italics in the original). This proposal seems adequate for the purpose at hand, but so far there has been little relevant research.

Miller (1948, 1951) has studied the acquired pain or fear drive in a number of situations, his results showing that neutral stimuli can acquire the capacity to elicit pain drive, and that a reduction of such an acquired pain drive (following removal of the cues) can reinforce new learning. When a pain drive is thus elicited, it is usually referred to as fear. Miller has also shown that the acquired fear is subject to extinction and spontaneous recovery (although

extinction of a fear response is usually difficult). A classical conditioning paradigm seems to account adequately for the acquisition of drive-eliciting power by the previously neutral cues.

If, as Miller has shown, the pain drive can come to be elicited by new cues, then it would appear reasonable to suppose that the so-called psychogenic or social motives may be physiological drives such as pain elicited by the cues of the situations in which they are displayed; this would be a function of associations previously made between the drives and the cues involved. Thus, the needs for achievement, autonomy, and affiliation may be primary motives elicited by the stimuli of competing or doing a job well, of behaving independently of the control of others, and of the presence of other persons, respectively--and so for the other social motives. The possibility that drives other than pain may be involved in these learned motives gave rise to the present research.



## PROBLEM

Dollard and Miller (1950) and Brown (1953) have shown how various social motives might be developed and maintained on the basis of conditioned fear or anxiety as described above. These accounts, as ingenious and important as they are, leave the reader with grave doubts-- it seems unlikely that chronic anxiety is sufficiently pervasive to make plausible the proposition that such a very large segment of human behavior is based upon it. There seems little reason to base social motives solely on aversive drive conditioning. In terms of Hull's corollary, such conditioning should apply also to the appetitive drives. There has been little research on the question, mainly because the appetitive drives are more difficult to control and much more gradual in their onset and offset than are the aversive drives (Brown, 1953).

Calvin, et al. (1953) reported an experiment in which they appeared to have established a learned drive based on hunger. Two groups of white rats were habituated, under 1 and 22 hrs. of food deprivation, to a triangular box painted inside with alternate black and white stripes. Habituation consisted of placing the Ss in the box 30 min. each day for 24 days; this was followed by 4 30-min. trials in which food was present in the box and all Ss were under 12 hr. deprivation. The animals habituated to the box under 22 hr. deprivation ate significantly more food than those habituated under 1 hr. deprivation. Siegel and MacDonnell (1954), however, failed to substantiate these findings in a repetition of the study.

Myers and Miller (1954) also failed to establish a secondary drive based on hunger. In addition to the effects of deprivation they studied

those of number of deprivation trials. They found no effects attributable to either of these variables, and interpreted the observed learning to have been motivated by "exploration."

A major purpose of the present research was to determine whether repeated association with a high level of an appetitive drive will empower cues to elicit that drive in human Ss. At the same time, an attempt was made to assess the importance of drive reduction, called for by the corollary quoted above, in the establishment of such drive-eliciting power. The drive studied was one based on thirst, defined as hours of deprivation of all liquids (except liquids contained in relatively dry foods). Thirst was chosen because it is a need, i.e., the basis of an appetitional drive, because it was expected to be easier to recruit Ss for water deprivation than for food deprivation, and because it would be easier and less expensive to reduce a drive based on water deprivation than one based on food deprivation.

In general, the procedure was as follows: Ss were instructed to abstain from all liquids beginning 24 hrs. before they came into the experimental situation. Of these, half were instructed to drink water until satiated one hour before coming. At these two levels of deprivation, then, Ss were habituated to the cues of the experimental situation, performing a task similar to but not identical with the one on which measures of the dependent variable were to be made. The task was selected in order to expose Ss to the cues of the dependent variable task, while avoiding possible differences in  $S^{E_R}$  as a function of different levels of drive in the habituation trials. "Habituation" refers here to three sessions spent in the experimental room under the

appropriate amounts of deprivation. A drink of water was given half the Ss in all habituation trials, and all Ss were given a drink of water halfway through the fourth trial, when the dependent response measures were made. In the last session, no Ss were deprived of water; the purpose of this fourth session was to discover if an association between the cues of the experimental room and Ss' levels of water deprivation had been established during the three habituation trials, such that the cues of the room would elicit different intensities of drive in the Ss of the different experimental groups, even though no Ss were under deprivation at this time.

The experiment was designed to test the following general hypotheses:

1. Ss habituated under high drive would perform better on the experimental task than those habituated under low drive.
2. Ss given water in the habituation trials would perform better on the experimental task than those not given water.
3. Ss habituated under high drive would show less decrease in reaction time (RT) as a function of practice after drinking water in the test than Ss habituated under low drive. (That is, performance of high drive Ss would be more affected by the drink of water than performance of low drive Ss.)
4. Ss given water in the habituation trials would show less decrease in RT as a function of practice after drinking water in the test than Ss not given water in the habituation trials. (That is, the drink of water would affect performance of Ss who had had water in habituation more than performance of Ss who had not.)

## METHOD

Forty female Ss between the ages of seventeen and sixty were recruited for this experiment. The original lower limit on age was 18 years, but two Ss 17 years old were found to have signed up, this discovery occurring in each case after one deprivation trial had been run. Since these Ss were in different drive groups, they were retained. Recruiting was from various classes on the campus of Montana State University and through personal contact with a number of students living in the city but not enrolled for summer session. As Ss were recruited, they were told that two experiments were to be run, that it was necessary to have the same Ss in both, and that they might be required to deprive themselves of all liquids including baths, showers, and high-water-content foods for three periods each of which might be as long as 26 hours, but none less than 23. As she signed up, each S was randomly assigned to one of the four experimental conditions and was given an appointment card and an instructions card which told in detail what was expected of her. The cards are reproduced in Appendix A.

The group of Ss as finally constituted comprised 40 females ranging in age from 17 (2 cases) to 59 (1 case) years, with a median age of 21. In all, 10 Ss were lost before the final 40 Ss were obtained and run; 2 because they failed to read and follow their deprivation instructions; 1 because of "personal reasons" at her own demand (these 3 were the only losses after participating in a deprivation period); and 7 who for various reasons decided that they could not or did not want to continue in the experiment. When an S dropped out, the next one recruited was used to replace her in her experimental condition.

The experiment was concerned with three independent variables at two levels of each: 1) high and low drive (D) based on water deficit (thirst) defined as hours of deprivation (1 and 24 hr.); 2) presence or absence of a reinforcer ( $G_h$ , + or -), defined as a drink of water given or withheld during the habituation trials; and 3) presence and absence of a presumed reinforcer ( $G_t$ ) during the test trial, with comparisons made of performance before and after its administration. The experimental conditions are defined in Table 1 and the design is schematized in Fig. 1; it is important to note that Fig. 1 refers to the conduct of the experiment, not to the data analysis.

Table 1

Definition of Conditions n=10 per group	
D (hr.)	$G_h$
1	-
24	-
24	+
1	+

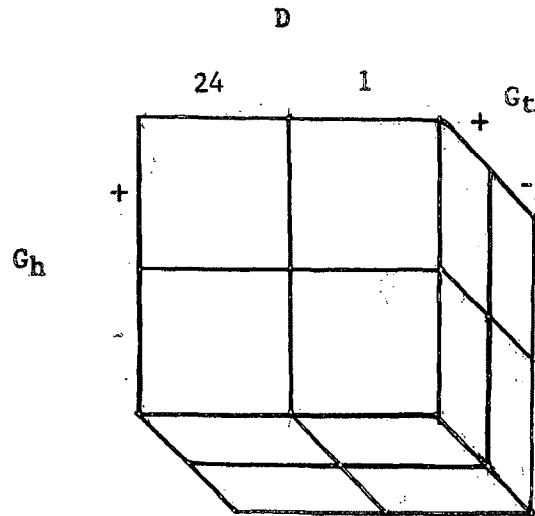


Fig. 1. Experimental Design

Dependent measurements were made on two tasks: the first was simple reaction time (RT) and the second a story-telling task patterned after the Thematic Apperception Test (TAT) procedure.

The RT apparatus, constructed by E, was similar to that used in most studies of simple RT except that S's response switch was a spring-loaded, normally off, single-pole single-throw toggle switch (AN 3022 8 ST 45C) instead of the usual telegraph key. The switch was mounted 3.75 in. from a screen with the handle inclined toward S. S's position between signals was with the thumb of the preferred hand resting on the head of a thumbtack driven into the base panel 1.75 in. in front of the switch, so that the response of striking the switch with the thumb could be made readily at the signal. An auditory signal was used (an ordinary Liberty brand electric doorbell buzzer, muffled with foam rubber inside the cover to reduce its intensity). The signal followed a verbal "ready" signal. Intertrial intervals were varied around a mean of five seconds. This was done by giving the ready signal every five seconds and varying the foreperiod from 1.5 to 2.5 sec. In order to avoid bias resulting from systematically varying foreperiods, a consistent pattern was followed in every RT test (cf. Woodworth and Schlosberg, 1954). The RTs were cumulated in 20-trial blocks on a .001 min. Standard Electric timer.

On a priori grounds, it appears that simple RT should reflect differences in drive; if drive is regarded as energizing behavior, then sensory-motor tasks such as RT should be performed better, the greater the drive strength present in the Ss at the time of their performance.

Support for this expectation was found in an early study (Johanson, 1922) in which knowledge of results given after each trial, and threat and actual delivery of electric shock for RTs exceeding a certain length were found to shorten simple RT. Further support derived from a study by Castaneda (1956) in which anxiety (measured by the Taylor Manifest Anxiety Scale) interacted significantly with sex, stimulus intensity, and sex and stimulus intensity jointly in reducing the length of simple RT. Wenar (1954) also found a significant effect of anxiety on simple RT. Other studies, however, such as those of Farber and Spence (1956) have failed to substantiate these findings; even Castaneda (1956) found no significant effect on RT attributable to anxiety alone. The RT task was finally used because pilot testing with Ss under 0 and 24 hrs. deprivation of liquids revealed differences which, although not statistically reliable, were in the predicted direction.

In the story-telling, or fantasy task, S was presented with two pictures in each habituation trial and four in the final test. S was instructed to write a story about each picture, on a prepared answer sheet given her by E. Descriptions of the pictures follow.

First habituation trial:

Picture I. Photograph of several basketball players awaiting a rebound, looking up in the air.

Picture II. TAT card 13B.

Second habituation trial:

Picture III. TAT card 17 GF.

Picture IV. Photograph of two men digging in the earth, and a third man, bearded, standing in the foreground with a shovel.

Third habituation trial:

Picture V. Harshly lighted, dramatic photograph of a man's face, sweating and contorted as in grief or pain.

Picture VI. TAT card 3 GF.

Fourth (test) trial:

Picture A1. A painting from a Ford advertisement--two men and a woman beyond the back of a station wagon, apparently picnicking; one man is pouring something from a large can, the other man and the woman are watching.

Picture A2. Photograph of a small Korean boy wearing a straw hat, holding a large enamel cup in his hands.

Picture B1. A young man in an asbestos suit, with the head piece tilted back, looking upward over his shoulder, sweating.

Picture B2. Color photograph of a lone figure in the desert, kneeling on the sand.

The A and B pictures were the two pairs used in the final test. These two pairs of pictures were counterbalanced with respect to before and after  $G_t$  in each experimental group. Thus, stories VII and VIII are the stories told before the test-trial drink of water ( $G_t$ ), half of the Ss writing about pictures A1 and A2 and the other half about Pictures B1 and B2; stories IX and X are the stories written after  $G_t$  about Pictures B1 and B2 by the Ss who wrote stories about A1 and A2 before  $G_t$  and about A1 and A2 by the Ss who wrote stories about B1 and B2 before  $G_t$ .

The procedure and scoring criteria (Table 2) were adapted from a study by Atkinson and McClelland (1948), in which it was found



possible to derive a reliable and valid measure of the need for food from imaginative productions. Scoring categories W and A were added by E after reading the stories.

Atkinson and McClelland based their scoring schema in part on Murray's (1938) need analysis and in part on their own analysis of a behavior sequence into need, instrumental activity, and goal activity. In addition to discriminating different levels of need for food, similar schemata have been applied to imaginative productions to differentiate levels of achievement motivation (McClelland et al., 1949), the affiliation motive (Atkinson, et al., 1954), and other needs. This procedure was therefore expected to reveal differences in the intensity of the need for water among our Ss.

In detail, the experimental procedures were as follows:

As each S arrived, she was seated before a small desk which held a pen, a book holder on which the pictures were placed, and her answer sheets. In the first trial, she was told:

"The first thing we will do is a test of creative imagination. I will show you some pictures, and I would like you to write a story about each one. You will have five minutes for each story. There will be four questions on your answer sheet; please answer each question for each picture, as you write the story about it--that is, incorporate the answers to the questions into your story. Try to spend about one minute answering each question. I'll help you keep track of time so you can finish all four questions in the time allowed. I'll tell you when to go on to the next question. You'll have time to go back and finish up any questions you haven't answered completely.

"Feel free to make up any kind of story you want--there are no right or wrong answers, of course. The more vivid and dramatic your story, the better. I would suggest you write as fast and as legibly as you can, in order to make your story about the picture as vivid, detailed, and imaginative as you can. Don't merely describe the picture; anyone can do that, of course. Make up a story about it. The four questions will guide your thinking so you can cover all the ground in the time required."

Table 2

Scoring Categories For Drive-Related Fantasy\*  
Each category scored each time it appears in total record.

<u>Category</u>	<u>Definition and Score of Category</u>
D th	Water deprivation thema: liquid deprivation is the central plot of the story. The deprivation story dwells on the threatening aspect of the situation, the person on the verge of inanition, etc. Instrumental activities are aimed at removing the deprivation. Difficulties in getting water are not scored D th unless central to the plot. Score; 1.
N	Need for liquid: someone in the story is actually stated to want liquids. Not to be inferred, e.g., from instrumental activity. N includes most themas referring to drinking and also all cases where someone wants liquids but the want is not central in the story. Score; 1.
D	Water deprivation: any shortage, scarcity, blocking by external agent, etc., leading to deprivation of liquids. Includes all D th stories and all other cases of liquid deprivation, whether or not water is central to the plot. Score; 1.
I,w or d,+ or -.	Instrumental activity aimed at getting liquid (Iw) or removing deprivation (Id); + if successful, - if unsuccessful. Score; Iw- or Id-, 1; Id+, -1.
G	Goal activity (terminal): someone is drinking, will drink immediately after the action, or has just drunk liquids. Any reference to drinking situations will be scored G. Score -1.
F <sub>p</sub>	Friendly press: someone in the story is invited to drink or helped to get water or other liquids. Score; -1.
A	Alcohol: any reference in the story to alcoholism, drinking of alcoholic drinks, or drunkenness. Score; 1.
W	Water: reference to rainy or stormy weather, floods, breaking of dam, etc. Score; 1.

\* Adapted from Atkinson and McClelland (1948).

E then handed S her answer sheets, saying:

"Here are the four questions:

"1. What is happening? Who are the persons?

"2. What led up to this situation? That is, what has happened in the past?

"3. What is being thought? What is wanted? By whom?

"4. What will happen? What will be done?

"If you need more space to answer any of these questions you may use the back of the answer sheet. Are there any questions? (E answered questions) Start writing as soon as possible after I give you the picture...Here is the first picture."

After each minute: "You should be starting the next question now."

After the fourth minute: "Please quickly finish any questions you haven't answered completely."

After the fifth minute: "That's all the time on this picture. Here is the next picture."

S was timed in this manner for each story. After the second story in each habituation trial, she was given a two-minute rest. On the second trial, her instructions were:

"We are going to repeat the test of creative imagination this time, using the same rules but with different pictures. Remember, tell a detailed, vivid, imaginative story about the picture, using the four questions as a guide. Be sure to answer all the questions. I will time you as before to help you finish in the time allowed. Any questions? Here is the first picture."

On subsequent sessions, S was simply told, "We will do the story-writing test again this time; you remember the arrangement? Here is your first picture."

In each habituation trial, after the story-telling task, S was asked to sit in the chair before the RT response switch, with both feet on the floor, her non-preferred hand in her lap, and her preferred hand on the response panel. E then said:

"Now I am going to start sounding a buzzer every 10 seconds, like this (E demonstrated). In each 10-second period, I would like you to

say a word--just any word that comes to mind, there are no right or wrong ones. Do you have any questions? . . . Let's try it a few times for practice."

The stimulus was delivered five times, with E recording the responses.

E then said: "That's fine, you have the idea; there's no need to hurry--just say any word after the buzzer sounds and before it sounds again. I'll ask you to do it 25 times more now. Are you ready? Okay."

E then delivered 25 more stimuli, recording responses.

The purpose of the task just described was to expose Ss to most of the cues of the RT task without permitting specific practice on RT, as mentioned in the statement of the problem.

Immediately after the RT habituation task, E administered to each S in the  $G_h^+$  condition a paper cup containing 8 oz. of water, saying: "Now please take a drink of water. Drink just as much or as little as you want." If S drank the whole cupful, she was offered another cupful. After S left the experimental room, the remainder was measured and the amount drunk was recorded.

In the  $G_h^-$  condition, S was told:

"Now I must ask you not to drink any liquids for one hour after you leave here, that is not until \_\_\_\_\_ (S was told the time she could drink). This is very important, so please hold off from drinking anything for another hour."

Following this, Ss were scheduled for their next appointment, thanked, and excused. After the third habituation trial, each S was told:

"As I told you, I must have your help in another experiment. This experiment will take only one session, but it will be a full hour long, so please make a special effort to be on time. There is no deprivation for this one-hour experiment. You don't have to go without liquids for it at all."

S's final appointment was then arranged.

When S arrived for her final test, she was first given two Fantasy cards, then a two-minute rest. E then instructed her as follows for the RT test, as he sat in the chair before the apparatus:

"This is a test to see how fast you can respond to a stimulus by making a simple movement--that is, a test of your reaction time. Sit as you have before, with both feet on the floor, your left (right) hand in your lap, and your right (left) on the panel; sit close enough so that you can rest your forearm on the table like this. Make your hand into a fist, like this, with your thumb sticking out, and then keep your thumb on this tack except when you are responding. I'll sound the buzzer every five seconds or so; each time, as soon as you hear the buzzer, I want you to strike this switch (demonstrating) and then return your thumb to its resting position as quickly as possible. Don't lift your thumb, because you may miss the switch; slide it along the panel. Don't hold the switch closed, because it may stick; strike it smartly with a movement of your whole forearm, like this, and then get back to the ready position as fast as you can. Now you try it a few times."

S was seated and allowed to strike the switch until she seemed to have the "feel" of it. E then said:

"Just before I sound the buzzer each time, I will say "Ready". My ready signal will precede the buzzer itself by from 1.5 to 2.5 seconds. It is extremely important that you not begin your movement until you actually hear the buzzer; if you anticipate the buzzer, the test will be ruined. Now let's try it a few times for practice."

E then delivered five stimuli, following which he corrected any errors S was making and told her that she was to have 20 trials of RT, then rest 30 seconds, then 20 trials more, and so forth until she had completed 100 trials. After the 100 trials, a three minute rest period was given. E presented S with a glass of water during the rest period, asking that she drink as much or as little as she wanted and pour the remainder into a glass graduate which he set before her. The amount of water consumed was recorded. S was then given 100 more trials, a one-minute rest period, and two more Fantasy pictures.

During the research, one subject reported having heard another telling some friends that she was not adhering to the deprivation conditions. As a result, E designed a questionnaire (See Appendix B) which was intended to be as disarming as possible, and which, among other things, asked that the Ss admit any violations of the deprivation instructions and give any information (without names) that they might have about the extent and number of Ss involved in such violations. This questionnaire was presented at the end of the last session, and Ss were asked to take it home, complete it, and return it. The questionnaires were identified with code numbers on the back. S had no indication, except the code number, that her answers were not anonymous.

At the end of the experiment, the following types of data were available for analysis: amount of water consumed by Ss in the  $G_h$  conditions during each habituation trial; drive-related fantasy scores for all Ss in the habituation trials and before and after  $G_t$  in the final trial, as well as the difference between before and after  $G_t$ ; total RT before  $G_t$ , total RT after  $G_t$ , and the difference in RT before and after  $G_t$ ; and finally, amount of water consumed in the test trial.

This research was concerned with 17 formal hypotheses; it was decided to regard as confirmed any hypothesis whose corresponding null hypothesis could be rejected at the .05 level of confidence. The directional hypotheses follow; corresponding null hypotheses are implied.

The first group of hypotheses relate to drive elicitation in the test trial:

H1: The group habituated under high drive (Hi D) should show more thirst-related fantasy before drive reduction than the group habituated under low drive (Lo D).

H2: The group habituated under Hi D will drink significantly more water in the test session ( $G_t$ ) than the group habituated under Lo D.

H3: There will be a significantly greater reduction in drive-related fantasy after  $G_t$  for the group habituated under Hi D than for the Lo D group.

The following group of hypotheses were designed to test Hull's principle that drive reduction in the presence of the associated stimuli is necessary for drive to be conditioned to the stimuli.

H4: The group given water ( $G_{h+}$ ) in the habituation trials will display more thirst-related fantasy before  $G_t$  than the group not so treated ( $G_{h-}$ ).

H5: The  $G_{h+}$  group will drink more water ( $G_t$ ) in the test trial than will the  $G_{h-}$  group.

H6: The D variable will be significantly more effective in producing thirst-related fantasy when paired with habituation-trial reinforcement than when not so paired. (This hypothesis was to be tested by the test of the  $D \times G_h$  interaction in the fantasy data.)

H7: The D variable will be significantly more effective in producing consumption of  $G_t$  when paired with  $G_h$  than when not so paired. (This hypothesis was tested by the test of the  $D \times G_h$  interaction in the  $G_t$ --water consumption in fourth session--data.)

H8: There will be a significantly greater reduction in drive-related fantasy after  $G_t$  for the  $G_t+$  group than for the  $G_h-$  group.

H9: The D variable will be significantly more effective in producing a decrement in drive-related fantasy after  $G_t$  when paired with  $G_h$  than when not so paired.

Hypotheses 3, 8, and 9 were to be tested by testing the differences in drive-related fantasy before and after  $G_t$  for the D,  $G_h$ , and  $D \times G_h$  effects, respectively.

A third group of hypotheses relates to the RT performance of the various groups before and after presumed drive reduction in the test, and the differences between these two scores. With D regarded as an energizer of behavior, the following hypotheses were tested:

H10: The group habituated under Hi D will display significantly shorter RTs than the group habituated under Lo D.

H11: The group habituated under Hi D will show greater differences in RT performance before and after  $G_t$  than the group habituated under Lo D.

The last group of hypotheses is also intended to test Hull's principle that drive reduction in the presence of the associated stimuli is necessary for drive to be conditioned to the stimuli.

It was hypothesized that:

H12: The  $G_h+$  group will have significantly shorter RTs before  $G_t$  than the  $G_h-$  group.

H13: The effectiveness of D in producing shorter RTs will be greater when D has been paired with  $G_h$  than when it had not been so paired.



H14: The  $G_h^+$  group will show less performance differences pre- and post- $G_t$  than will the  $G_h^-$  group.

H15: The  $D$  variable will be more effective in producing RT performance differences between pre- and post- $G_t$  when it is paired with  $G_h$  than when it is not so paired.

Hypotheses 11, 14, and 15 were tested by the analysis of the  $RT_1$ - $RT_2$  data.

In addition to the above, two hypotheses were to be tested in an attempt to assess the effectiveness of the deprivation instructions:

H16: The Hi  $D$ ,  $G_h^+$  group would drink significantly more water in the habituation trials than the Lo  $D$ ,  $G_h^+$  group.

H17: The Hi  $D$  group, disregarding  $G_h$ , should display more drive-related fantasy during the habituation trials than the Lo  $D$  group.

## RESULTS

Stories for the Fantasy measure were scored in the following manner: first, E read all the stories, retaining for further analysis all those containing reference to excessive heat, liquids in any form, thirst, deprivation, or swimming, and assigning scores of zero to all other stories, which were then set aside. The former group of stories were then reread, and scoring categories W and A were added to the scoring schema adapted from Atkinson and McClelland (1948). See Table 2 for the final scoring schema. The stories were then scored, the scores being recorded on data sheets. The aid of two other graduate students (EAS and HAW) was then enlisted to score independently 25 stories selected by E. The stories were chosen so as to represent a major portion of the range of scores E had obtained. Pearson product-moment correlations were then computed for all pairs of scorings; the reliability coefficients obtained are presented in Table 3. These coefficients are sufficiently high to permit the

Table 3  
Reliability Coefficients ( $r$ ) for  
Scoring Fantasy Stories

Scorers	$r$
OCV--EAS	.806
OCV--HAW	.931
EAS--HAW	.907

conclusion that scoring was reliable. E therefore retained his own scoring of the remaining protocols.

The data thus obtained proved very difficult to analyze. Two-way analyses of variance were applied to the data from the test trial, and

t-tests to the scores of the protocols obtained in the habituation trials, the scores having first been transformed to  $\sqrt{X+1.5}$  to eliminate zero and negative scores and correct the strong positive skew present in the data. The analyses of variance for stories VII and VIII (pre- $G_t$ ), stories IX and X (post- $G_t$ ), and the difference between pre- and post- $G_t$  scores are presented in Tables 4, 5, and 6, respectively. The F-ratios obtained for the drive variable on stories IX and X and the difference scores are both significant at the .05 level of confidence for the df available. The mean transformed Fantasy scores for the test trial are presented in Table 7.

Two factors urge a conservative interpretation of the F-ratios in Tables 4, 5, and 6. The first is that Bartlett's test for homogeneity of variance, applied to these data, yielded values of chi-square significant at the .01 level. Although Bartlett's test is sensitive to degrees of inhomogeneity which do not materially affect the F-ratio (Lindquist, 1953), any inhomogeneity in the data will operate to increase the probability of a given value of F. The second factor is that the small size of the non-transformed means renders transformations of the scale questionable (Edwards, 1950). Accordingly, further analyses were performed with the original scores.

The test used was the Kruskal-Wallis one-way analysis of variance by ranks (Siegel, 1956), a nonparametric test which permitted a test of the general hypothesis that there would be differences among the experimental groups in amount of drive-related fantasy displayed before drive reduction, after drive reduction,

Table 4  
Analysis of Variance of Drive-Related Fantasy  
In Stories VII & VIII (Pre-G<sub>t</sub>)

Source	SS	df	VE	F
BG	.507	(3)		
D	.279	1	.279	1.484
G <sub>h</sub>	.102	1	.102	.542
DxG <sub>h</sub>	.126	1	.126	.670
Within	6.752	36	.188	
Total	7.259	39		

Table 5  
Analysis of Variance of Drive-Related Fantasy  
In Stories IX & X (Post-G<sub>t</sub>)

Source	SS	df	VE	F
BG	2.154	(3)		
D	1.347	1	1.347	4.794*
G <sub>h</sub>	.063	1	.063	.224
DxG <sub>h</sub>	1.744	1	.744	2.648
Within	10.131	36	.281	
Total	12.285	39		

\*  $p < .05$

Table 6  
Analysis of Variance of Differences in Drive-  
Related Fantasy (Pre-minus Post-G<sub>t</sub>)

Source	SS	df	VE	F
BG	5.635	(3)		
D	4.019	1	4.019	7.63*
G <sub>h</sub>	.141	1	.141	.27
DxG <sub>h</sub>	1.475	1	1.475	2.80
Within	18.975	36	.527	
Total	24.610	39		

\*  $p < .05$

and corresponding differences in changes of Fantasy scores from before to after drive reduction. The obtained  $H$ -ratios are presented in Table 8; none of these ratios was large enough to permit rejection of the associated null hypothesis. This completes the tests of hypotheses H1, H3, H4, H6, H8, and H9, and of the general hypothesis from which they were derived.

The means for  $G_h$  (amount of water consumed by  $G_h+$  group during habituation) and drive-related fantasy, both cumulated over all habituation trials, are presented in Table 9. The  $G_h$  data were tested with  $t$ -tests, yielding values of  $t$  less than unity; the specific  $t$ -ratios are therefore not presented here. Chi-square tests of differences between drive groups in proportions of  $Ss$  showing drive-related fantasy also yielded values of chi-square which fell far short of significance. Thus, hypotheses H16 and H17 failed to receive support.

Analysis of variance applied to the  $G_t$  data (amount of water consumed in the test, or final, trial), for a test of hypotheses H2, H5, and H7, yielded the results presented in Table 10; none of these  $F$ -ratios is at an acceptable level of significance. Mean  $G_t$  scores for the various groups are presented in Table 11.

In Table 12 are the results of the analyses of variance of the RT data. For these analyses, scores were transformed to  $1/RT$ , because RT scores are generally skewed (Woodworth and Schlosberg, 1954). The resulting scores represent speed of response (RS). Again, analyses yielded no  $F$ -ratios at acceptable levels of significance.

**Table 7**  
**Mean Fantasy Scores ( $\sqrt{X+1.5}$ ) in the Final Test Trial**

Condition	Stories	
	VII & VIII	IX & X
Hi+	1.24	1.85
Hi-	1.45	1.66
Lo+	1.52	1.21
Lo-	1.51	1.57

**Table 8**  
**Kruskal-Wallis H-Values for Differences in Drive-Related Fantasy**

Stories	H
VII and VIII	2.69
IX and X	6.30
Difference	7.50

**Table 9**  
**Mean Total Oz. Water ( $G_h$ ) Consumed and Mean Total Fantasy in Habituation Trials**

Condition	$G_h$		Fantasy
	Lo D	20.97	1.58
	Hi D	23.45	1.58

**Table 10**  
**Analysis of Variance:  $G_t$  Data**

Source	ss	df	VE	F
D	2.16	1	2.16	.242
$G_h$	6.30	1	6.30	.707
$D \times G_h$	31.88	1	31.88	3.578
Within	320.68	36	8.91	
Total	361.02	39		

Table 11  
Mean Oz. Water ( $G_t$ ) Consumed  
In Final Trial

Drive	Hi	Lo
+	4.19	5.51
$G_h$ -	6.77	4.52

Table 12  
Analysis of Variance: 1/RT Data

Time	Source	ss	df	VE	F
Before $G_t$	D	.007	1	.007	.004
	$G_h$	.192	1	.192	1.223
	$D \times G_h$	.203	1	.203	1.293
	Within	5.653	36	.157	
	Total	6.055	39		
After $G_t$	D	.0001	1	.0001	.0005
	$G_h$	.0367	1	.0367	.1922
	$D \times G_h$	.0634	1	.0634	.3321
	Within	6.8727	36	.1909	
	Total	6.9729	39		
Difference	D	.008	1	.008	.143
	$G_h$	.060	1	.060	1.071
	$D \times G_h$	.039	1	.039	.696
	Within	2.018	36	.056	
	Total	2.125	39		

## DISCUSSION

The results of this investigation offer no support to the basic hypothesis which generated it--that a drive based on an appetitive need can be conditioned to cues which can then, at a later time, elicit a drive state. Little more can be said about the results; the failure to obtain evidence of differences in drive during the habituation trials prevents any conclusions relevant to the basic hypothesis regardless of the results of the final, test trial. Perhaps, however, some consideration of possible reasons for the negative results obtained is in order--if nothing else, to preclude the hasty conclusion that such learning is not possible.

The most basic fact which appears from examining these data is that there is no evidence that the deprivation instructions resulted in measurable differences in drive in the habituation trials, as determined from drive-related fantasy and from amount of water drunk by Ss in the two drive conditions. This could have occurred either because of Ss' failure to comply with those instructions, or because the measures taken are not adequate indices of drive or of physiological need. The first of these possibilities comprises two main possible factors; first, Lo D Ss may have failed to satisfy their thirst one hour before each of the habituation trials, as they were instructed. No evidence relevant to this possibility was obtained. Second, a large proportion of Ss in all groups may have violated the deprivation instructions extensively. The questionnaire mentioned earlier was designed to obtain evidence on



this point. Of the 40 Ss, 18 reported that they had not violated the instructions and knew of no violations by other Ss; 5 reported inconsequential violations of their own and 3 reported inconsequential violations by others; 5 reported violations, seriousness unspecified, by others; and 7 reported serious violations (1 or more glasses of liquid, a bath, or restriction of diet to high-water-content foods) by themselves and 8 reported such violations by others. It is impossible to say how reliable the questionnaire responses are, or to what extent the reports of violations by others refer to the same Ss. Reanalysis of the data after eliminating the scores of Ss admitting serious violations revealed no significant differences.

The second major possibility, that the measures of drive strength were inappropriate, arises first of all in the case of the amount of water ingested in the various trials. Although this appears a priori to be a most reasonable index of need for water, such may not be the case at all. The greater part of the physiologically necessary water supply is probably derived from sources other than the drinking of water itself--juicy foods, fruit juices, milk, coffee, tea, and the like. It is quite conceivable that had the Ss been offered orange juice, significant differences in amount consumed would have been found. Some Ss commented spontaneously that they wished to get home quickly after the laboratory sessions because they had a supply of cold fruit juices, soft drinks, etc. there. Another possibility is that deprivation for 24 hours makes little difference in consumption of water, relative to individual differences.

Other factors which might interfere with the validity of water consumption as a measure of the need for water are other deprivation symptoms such as headaches, weakness, aching, nausea, loss of balance, etc., which could have rendered Hi D Ss less likely to drink much at the end of deprivation. The only systematic difference observed in this respect, however, was a tendency for the older Ss to report more severe and extensive symptoms.

It might be questioned whether Fantasy is a sensitive measure of differences in physiological need. Atkinson and McClelland (1948) obtained evidence that it is, but they also found that considerable drive-related imagery must be elicited from all groups in order for significant differences to appear. The pictures used in the habituation trials simply did not elicit large amounts of thirst-related fantasy, although pilot testing had suggested that they would. Stories were scored in several ways other than by the schema presented in Table 2, but none of these methods resulted in any improvement, and some reduced discrimination between the groups. Of course, the pictures used in the test situation did elicit a good deal of relevant imagery, so that if one assumes that there were differences in drive during the habituation trials which were not reflected in the measure used, one must then take a conservative view of the ease of conditioning a drive based on thirst.

Finally, RT may be insensitive to drive. The task was used because of the results of pilot testing, despite the equivocal evidence on its usefulness as an index of drive strength. The present

study offers no evidence on this point, since there is no evidence that differences in D occurred among the experimental groups.

For purposes of further study, the safest conclusion is that no measured differences in drive resulted from the deprivation instructions. This leaves open the question of the conditionability of a drive based on water deprivation. Further tests of this problem should probably be conducted with Ss whose physical environment can be rigorously controlled. Under such conditions, need for water could be defined as hours of deprivation, rather than predicted on the basis of assumed compliance with deprivation instructions. It would be valuable, under such circumstances, to explore the length of deprivation necessary to produce measurable amounts of drive, the number of deprivation trials necessary to condition drive (if it can, in fact, be conditioned), and the effects of deprivation on a variety of tasks--RT, Fantasy, maze learning, and others--the list of possibilities is virtually endless.

If the present study were to be repeated under more stringent control of the deprivation factor, it would probably be well to require all Ss to drink a standard amount of water in each of the trials, since the amount drunk by Ss under self-regulated conditions appears to be determined by several factors other than physiological need.

## SUMMARY

Secondary drive is hypothesized in order to account for the energizing of behavior which is directed toward goal states which cannot affect physiological functioning directly. Much evidence exists for the learnability of pain drive, but little for the learnability of drives based on appetitional needs. An attempt was made to determine whether Ss instructed to deprive themselves of liquids in certain ways would show differences in drive-related Fantasy, and in amount of water consumed in an experimental setting, and whether being introduced later to the cues of the experimental situation would produce differences in Fantasy, water consumption, and simple reaction time. Ss were 2 groups of 20 women each, instructed in such a way as to produce a presumably high level of need for water in one group and a low need for water in the other group. Half of each of these groups was given a drink of water in each of three trials under deprivation. All Ss were then tested under presumed conditions of zero physiological need for water. Statistical tests appropriate to the data failed to support any of the hypotheses tested. Scoring of the Fantasy stories was found to be reliable.

Measures designed to indicate whether the different instructions had in fact produced differences in drive did not reveal significant differences between the high and low drive groups. It was therefore not possible to draw conclusions regarding the experimental hypotheses. Possible factors contributing to the negative findings of the study are: a) failure to induce differences in drive with the deprivation instructions, and b) insufficient sensitivity to drive in the measures used.

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## APPENDIX A

### Facsimiles of the Appointment and Instruction Cards

#### Given Ss in This Experiment

##### APPOINTMENT CARD (Experimental room is JC 116)

Below is the time of your next appointment, and the time after which you are asked not to bathe, shower, or consume liquids. It is very important that you adhere strictly to the no-liquid conditions, on schedule. Keep it in mind or you may take a drink inadvertently. Refer to the instruction card when in doubt about any food item or other details.

<u>Appointments</u>		<u>No liquids after--</u>	
1. Time _____	Date _____	Time _____	Date _____
2. Time _____	Date _____	Time _____	Date _____
3. Time _____	Date _____	Time _____	Date _____
4. Time _____	Date _____	Not necessary to avoid liquids for the 4th session.	

##### INSTRUCTIONS: Follow closely--do not lose.

1. Just before the time indicated under "No water after--" on your appointment card, drink all the water you want. Then:
2. Discontinue all liquids; don't drink water, tea, coffee, milk (even on cereal), fruit juices, soft drinks or alcoholic beverages.
3. Don't eat soup, ice cream, oranges, grapefruit, watermelon, or canned fruits. Avoid other high-water-content foods.
4. Don't bathe or shower during deprivation.

##### NOTICE: Avoid vigorous exercise during deprivation.

If, for any reason, you can't continue in the deprivation condition, notify me as soon as possible.

## APPENDIX B

### Questionnaire given Ss after the end of Trial 4

Do not write your name on this sheet.

To begin with, I want to thank you for your part in making this research a success so far. It is only necessary that you answer the questions on these pages, in order to complete the information we need. This questionnaire is an integral part of the research. It is extremely important that it be filled out promptly and returned to Mr. Vick. There is no need to ponder the questions at length; just answer them as honestly as you can, and then return the questionnaire sealed in its envelope (you may slip it under the door of JD 220 or the Psychology Department office).

One of the purposes of this research is to determine the difficulty of undergoing the deprivation which you have undergone. This particular aspect of the research is extremely important--along with other aspects of the experiments, it is expected to yield information of great value in predicting and understanding the behavior of military personnel under stress when they are deprived of some important part of their normal diet. Complete and honest answers are absolutely necessary if the research is not to be dangerously misleading.

DO NOT SHOW THIS QUESTIONNAIRE TO OR DISCUSS IT WITH ANYONE!

1. How thirsty did you get during the deprivation periods?
  - a. No thirstier than normal
  - b. Extremely thirsty--almost unbearable
  - c. Moderately thirsty (more than slightly, but not too bad)
  - d. Very slightly thirsty
  - e. Very thirsty, but quite bearable
2. How hungry did you get during the deprivation periods?
  - a. Very hungry, but quite bearable
  - b. Moderately hungry
  - c. Very slightly hungry
  - d. No hungrier than normal
  - e. Extremely hungry--hardly bearable
3. How tired did you get during the deprivation periods?
  - a. Extremely tired--almost unbearable.
  - b. Very tired, but quite bearable
  - c. No more tired than normal
  - d. Moderately tired.
  - e. Very slightly tired
4. Did you notice any difference in the intensity of thirst in the different deprivation periods? Yes \_\_\_\_\_ No \_\_\_\_\_  
If "yes", please explain briefly.



5. Rank in terms of when you were most thirsty, assigning #1 to the time when thirst was greatest, #2 to the next most thirsty time, etc.

- ☐ When the laboratory session was in progress
- ☐ Immediately after starting deprivation
- ☐ A short time after deprivation started
- ☐ Just prior to coming to the laboratory
- ☐ About halfway between start of deprivation and the laboratory session

6. What effects other than thirst, hunger, or fatigue or lethargy (if any) resulted from the deprivation? List them briefly, tell how many deprivation sessions they occurred in, whether they started during or after the deprivation period, how long they lasted, and rate them as severe, mild, moderate, or very severe.

7. Have you any reason to believe that any subject or subjects at any time violated the deprivation instructions? (This question is most important--do not give names, but please answer it honestly.)  
Yes ☐ No ☐. If "yes", please estimate the amount of this that occurred, and how many subjects were involved.

8. Did you at any time violate the deprivation instructions?  
Yes ☐ No ☐. If "yes", how often and in what way or ways?

Needless to say, the information in this questionnaire will be held strictly confidential and will not affect you in any way, whether you were able to adhere strictly to the deprivation instructions or not.

Thank you again for your cooperation.

Odin C. Vick

**REMEMBER: DO NOT DISCUSS THE EXPERIMENTS WITH ANYONE!!**